

REMARKS

REGARDING APPLICATION STATUS

Claims 1-20 were rejected. Claim 1 is amended herein to incorporate subject matter of claim 8. Claim 8 is cancelled accordingly. No claim is newly added. By this Amendment, claims 1-7 and 9-20 are pending.

REGARDING 35 USC § 102(b) REJECTIONS.

Claims 1-4, 9, and 13-16 were rejected under 35 U.S.C. § 102(b) as being anticipated by R.M. Mihalcea, et al., "Diode-laser absorption measurements of CO₂ near 2.0 μ m at elevated temperatures" published December 20, 1998 in Vol. 37 No. 36 of APPLIED OPTICS (hereinafter referred as "Mihalcea"). The rejections are respectfully traversed. Reconsideration is earnestly solicited in view of the amendments presented herein and the following remarks.

Applicants respectfully disagree with the statement that the claimed invention is "anticipated" by Mihalcea. As the case laws made clear,

"[a] claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference." *Verdegaal Bros. v. Union Oil Co. of California*, 814 F.2d 628, 631, 2 USPQ2d 1051, 1053 (Fed. Cir. 1987). "The identical invention must be shown in as complete detail as is contained in the ... claim." *Richardson v. Suzuki Motor Co.*, 868 F.2d 1226, 1236, 9 USPQ2d 1913, 1920 (Fed. Cir. 1989).

The present application taught and claim, among others,

"selecting the R(50) spectroscopic transition of the $\nu_1+2\nu_2+\nu_3$ CO₂ absorption band in near-infrared;" and
"utilizing said laser sensor to spectrally interrogate said R(50) spectroscopic transition for sensitive measurements of CO₂."

Mihalcea neither expressly nor inherently teaches each and every element as specifically taught in the present application and particularly set forth in the claims. The Examiner contended that Mihalcea

“**proposes** that *in situ* measurements **may be taken** of the transition lines of the CO₂ transition band including the R(56), R(38), and R(50) lines at elevated temperatures in excess of 400K,” emphasis added, citing p. 8345, cols. 1 and 2 of Mihalcea.

The phrases “proposes” and “may be taken” suggest that the Examiner apparently recognized that Mihalcea does NOT, either expressly or inherently, teach or suggest, among others, how to spectrally interrogate the R(50) transition line for sensitive measurements of CO₂. That is, there are no enabling teachings in Mihalcea of how *in situ* measurements are or can be taken of the R(50) transition line of the CO₂ transition band at elevated temperatures in excess of 400K.

Mihalcea does teach how to obtain *in situ* measurements of CO₂ concentrations at elevated temperatures utilizing the R(56) line. However, Mihalcea merely lists R(50) as a potential CO₂ transition. The only sentence in Mihalcea that relates to R(50) is recited below:

“Additional potential CO₂ transitions for *in situ* detection at elevated temperatures might be the R(38) line at 5002.487 m⁻¹ or the R(50) line at 5007.787 cm⁻¹ (20012 ← 00001 band).”

One skilled in the art would have agreed that this is a general statement and that Mihalcea merely proposes that it is possible to use other spectroscopic transitions for the measurement of CO₂ in high-temperature conditions. Other than the R(56) line, Mihalcea lacks **detailed enabling teaching** of any specific transitions or wavelengths. The realm of possible other wavelengths is so vast and vague as to be worthless in terms of teaching specific solutions to the problem of monitoring CO₂.

Clearly, Mihalcea simply does not teach the R(50) transition as a possible solution, nor whether the use of the R(50) transition is of value. In fact, this prior work is restricted to interrogating the R(56) line at 5010.035 cm⁻¹ for combustion monitoring [Spec. page 15, lines 4-16]. Other unduly difficulties in implementing Mihalcea also exist, *id.*

Interestingly, Mihalcea seems to teach away from *selecting* the R(50) line. “Within this spectral region [5000-5015 cm^{-1}], the R(56) line of the CO_2 20012 \leftarrow 00001 band was selected for *in situ* measurements of CO_2 concentrations”, p. 8345, col. 1. The fact that Mihalcea teaches away from the R(50) line renders the claimed invention *prima facie* not obvious over Mihalcea. The non-obviousness of the claimed invention over Mihalcea is further discussed in the following section under the heading “Regarding 35 U.S.C. § 103(a) Rejections”.

In summary, at best, Mihalcea amounts to an educated guess, not an invention identical to the present invention, and certainly not an enabling teaching with as complete detail as is contained in the claims, particularly claims 1-4, 9, and 13-16, of the present application.

As a bona fide attempt to forward the present application to a condition for allowance, independent claim 1 of the present application is amended herein to recite a spectrally resolved technique for interrogating the R(50) transition line. Claim 8 is accordingly cancelled. Reconsideration of the allowability of claims 1-4, 9, and 13-16 are earnestly requested.

REGARDING 35 USC § 103(a) REJECTIONS.

Claims 5-8, 10-12, and 17-20 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Mihalcea in view of Brand *et al.* (U.S. Pat. No. 6,064,488, hereinafter referred to as “Brand”). The rejections are respectfully traversed. Reconsideration is earnestly solicited in view of the amendments presented herein and the following remarks.

Having distinguished Mihalcea, the obviousness questions remain, “could someone have quantified the mere proposal in Mihalcea?” “If so, how?” Hypothetically, if one could have realized the R(50) transition line as proposed by Mihalcea, “would such a knowledge/skill generally available to one of ordinary skill in the art to which the claimed subject matter pertains?”

The mere fact that references can be combined or modified does not render the resultant combination obvious unless the prior art also suggests the desirability of the combination. *In re Mills*, 916 F.2d 680, 16 USPQ2d 1430 (Fed. Cir. 1990) (emphasis in original.) Obviousness can only be established by combining or modifying the teachings of the prior art to produce the claimed invention where there is some teaching, suggestion, or motivation to do so found either in the references themselves or in the knowledge generally available to one of ordinary skill in the art. *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988); *In re Jones*, 958 F.2d 347, 21 USPQ2d 1941 (Fed. Cir. 1992).

There is no proper teaching, suggestion, or motivation to modify Mihalcea with Brand so as to arrive at the invention as claimed. That is, neither Mihalcea nor Brand teaches or suggests the desirability of the combination. The Examiner contended that

“it would have been obvious to a person of ordinary skill in the art at the time of the invention was made to modify the system and method of [Mihalcea] to incorporate the types of lasers, techniques, and optical structure taught by [Brand] as the use of each of these structures in *in situ* measurement of gas concentration contribute to producing a more accurate measurement,” emphasis added, citing col. 2, lines 5-24, of Brand.

As the Examiner noted, Mihalcea explicitly lacks teachings related to certain elements recited in claims 5-8, 10-12, and 17-20, e.g., process chamber, sampling line, lasers, and interrogation techniques. Mihalcea itself does not teach or suggest the desirability of the combination as set forth in the pertinent claims.

On the other hand, the cited column and lines of Brand refer to a general statement that

“[t]he combination of sample signal and null signal, with the reference signal providing an accurate wavelength control, yields an accurate concentration measurement.”

Again, Brand itself does not teach or suggest the desirability of the combination as set forth in the pertinent claims.

Since neither Mihalcea nor Brand seems to provide any proper motivation or desirability to combine or modify one another so to arrive at the invention as set forth in the present claims, presumably, the rejection

“the use of each of these structures in *in situ* measurement of gas concentration [as taught by Brand] contribute to producing a more accurate measurement [as taught by Mihalcea]”

would have been based on facts within the personal knowledge of the Examiner. When a rejection is based on facts within the personal knowledge of the Examiner, the data should be stated as specifically as possible, and the facts must be supported, when called for by the applicant, by an affidavit from the Examiner [MPEP 2144.03]. Applicants respectfully request that the Examiner cite a reference or provide an affidavit in support of his statement.

Since obviousness cannot be established absent some teaching, suggestion or incentive supporting the modification/combination, the examiner has not established a *prima facie* case of obviousness (ACS Hospital Systems, Inc. v. Montefiore Hospital, 732 F. 2d 1572, 1577, 221 USPQ 929, 933 (Fed. Cir. 1984)). Absent such a showing in the prior art, the examiner has impermissibly used the applicant's teaching to hunt through the prior art for the claimed elements and combine them as claimed (see *In re Vaeck*, 947 F. 2d 488, 20 USPQ 2d 1438 (Fed. Cir. 1991); *In re Bond*, 910 F. 2d 831, 15 USPQ 2d 1566 (Fed. Cir. 1990); *In re Laskowski*, 871 F. 2d 115, 117, 10 USPQ 2d 1397, 1398 (Fed. Cir. 1989)). The use of hindsight is never permissible to establish obviousness.

Notwithstanding the lack of proper motivation to modify or combine, simply combining Mihalcea and Brand as the Examiner has suggested would NOT have produced a more accurate measurement as set forth in the present claims. This is at least because, as discussed above, Mihalcea lacks specific enabling teachings on how to spectrally interrogate the R(50) transition line for sensitive measures of CO₂ in a high temperature gas flow containing water vapor, as set forth in the claimed invention.

Consequently, modifying Mihalcea with a kitchen sink of lasers, techniques, and miscellaneous structural elements as provided by Brand would not have arrived at the

invention as claimed, even assuming the skills in doing so were in the general knowledge of one skilled in the art at the time of the invention.

For those skilled in the art, the claimed invention would not have been obvious because the discovery of the suitability of the particular wavelength in question was the result of dedicated computer simulation, modeling, proper interpretation of the models, and experimental verification. Those skilled in the art have been working for over 20 years on the topic of *in situ* CO₂ monitoring in combustion applications without having identified that particular wavelength. If it were obvious, then one of the many dozens of prior publications would have identified it and thoroughly described how to use it in experimental research. Thus, it is fair to say that the wavelength simply wasn't obvious.

This is supported by the fact that, as discussed before, Mihalcea teaches away from selecting the R(50) transition line. Although proposing the R(50) transition line as a potential, Mihalcea specifically selects the R(56) transition line of the CO₂ 20012 \leftarrow 00001 band for *in situ* measurements of CO₂ concentrations within the same spectral region (5000-5015 cm⁻¹), *supra*.

Mihalcea's selection agrees with results from typical computer models available to one skilled in the art at the time of the invention. That is, one of ordinary skill in the art, reading Mihalcea as a whole, would not have been motivated to modify Mihalcea so as to arrive at the invention as claimed because typical computer models suggest it is not useful. Moreover, as discussed in the present application, it would have been unduly difficult to modify Mihalcea [Spec. page 15, lines 4-16].

CONCLUSION

Mihalcea and Brand, individually and in combination, as well as other cited prior art, do not teach or suggest, *inter alia*, a method and a system implementing the method for non-intrusively measuring carbon dioxide in a high temperature gas flow containing water vapor, comprising:

selecting the R(50) spectroscopic transition of the $\nu_1+2\nu_2+\nu_3$ CO₂ absorption band in near-infrared; and

utilizing a laser sensor to spectrally interrogate the R(50) spectroscopic transition for sensitive measurements of CO₂.

The present invention specifically identifies, thoroughly teaches, and particularly claims the R(50) spectroscopic transition from amongst the thousands available to be an optimum one for *in situ* monitoring. With proper use and interpretation of the computer models, the present invention was reduced to practice by way of a novel and non-obvious approach in accordance with the particulars of the present application. The viable solution described in the present application offers an advantageous technical contribution to the society.

For at least the foregoing reasons, it is respectfully submitted that independent claims 1 and 9 respectively recites subject matter not reached by the closest prior art of record under 35 U.S.C. § 102(b) and/or 35 U.S.C. § 103(a) and therefore should be allowed. Reliance is placed on *In re Fine*, 5 USPQ 2d 1596, 1600 (Fed. Cir. 1988) and *Ex parte Kochan*, 131 USPQ 204 (Bd. App. 1960) for allowance of the dependent claims 4-7 and 10-20, since they differ in scope from their parent independent claims 1 and 9, which are submitted to be patentable.

This Reply is submitted to be complete and proper in that it places the present application in a condition for allowance without adding new matters. Since the examiner has done a thorough search in the first Office action in light of the entire application disclosure and claims, no new search should be necessary. Favorable consideration and a Notice of Allowance of all pending claims are therefore earnestly solicited.

The Examiner is sincerely invited to telephone the undersigned for discussing an examiner's Amendment or any suggested actions for accelerating prosecution and moving the present application to allowance.

Respectfully submitted,



Katharina Wang Schuster, Reg. No. 50,000
Attorney for the Applicants

LUMEN INTELLECTUAL PROPERTY SERVICES
2345 Yale Street, Second Floor
Palo Alto, CA 94306
(O) 650-424-0100 x8413 (F) 650-424-0141